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Department of Home Economics

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Some Points in the Making and Judging of Bread

By

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PREFACE

For many years the Household Science Department of the University of Illinois has been interested in various phases of the bread question, and members of the Department, both faculty and students, have worked with bread. Much of the earlier work was done by Miss Anna VanMeter, Miss Ruth A. Wardall, and Miss Carolyn Busey, under the direction of the author; the later work largely by Miss Katherine Jensen and Miss Anna Williams, under the direct supervision of Dr. N. E. Goldthwaite. This bulletin has been prepared for the purpose of bringing together the results of these experiments.

Note to Fourth Edition.—The war taught people a great deal about the use of flour and flour substitutes, and particularly that good breads could be made with a large proportion of other ingredients than the flour of hard spring wheat. The war also emphasized the economic importance of using home-grown products. According to the Report of the State Board of Agriculture, in 1918 Illinois produced 40,498,958 bushels of wheat of the variety known as winter wheat. This yields what is known in common terms as a soft wheat flour. Since this wheat is a home-grown product, and experiments have shown that a very good type of bread can be made from it, its use in bread making should be encouraged. Pages 30 and 31 give the methods for using a soft wheat flour.

While the processes and technic of bread making in the home and some of the physical and chemical problems involved, as discussed in the following pages, have not been changed materially, yet in the last few years modern industry has developed bread making on a tremendous commercial scale, and, as a result, considerable addition has been made to our knowledge of the processes along the lines of physical and biological chemistry. For those interested in these phases of the subject, the following references are given.

Elizabeth Sprague, "Study of Yeast Breads with Substitute Flours," Journal of Home Economics, June, 1918, p. 272-9.

Emil Braun, "The Best Ways to Use Substitutes," The Northwestern Miller, September 25, 1918, p. 1063.

E. J. Cohn and L. J. Henderson, "The Physical Chemistry of Bread," Science, November 22, 1918, p. 501-5.

Robert Kennedy Duncan, "Some Chemical Problems of Today," p. 143-161, 231, 237.

Caroline L. Hunt and Hannah L. Wessling, "Bread and Bread Making in the Home," Farmers' Bulletin 807, U. S. Department of Agriculture.

Isabel Bevier

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SOME POINTS IN THE MAKING AND JUDGING OF BREAD

"Bread is the staff of life." This old and familiar statement represents a universal idea, for, in whatever terms it may be expressed, there is very general agreement as to the value as food of some form of bread. The German, the Frenchman, the Englishman, and the American may have in mind a very different product, yet each of them would agree to the general statement.

Aside from its value as food and its vast commercial importance, bread has a peculiar interest to women because, while many primitive industries have gone from the home, statistics[1] seem to show that seventy percent of the bread used in the United States is made in the home. If this statement be true, it indicates at once the responsibiliy of the American housekeeper for the standard of bread and her opportunity to influence that standard. If she is to meet this responsibility wisely and well, knowledge of various kinds about bread is demanded of her. She must know its sources, its value as food, the factors of bread making, the cost in time, energy and materials. In short she must have an ideal of what good bread is and be familiar with the details of the process by which it may be obtained. She must be able to recognize essentials and non-essentials in the process. The Book of Bread,[2] for example, gives some three hundred recipes for making bread and all of them agree that to obtain desirable results, yeast and flour must be in good condition and must be kept at a proper temperature throughout the process.

This bulletin proposes to deal with but two of the innumerable types of bread to be found: first, that made from the flour obtained from spring wheat, and, second, that made from the flour obtained from winter wheat.

The study of a product so familiar as bread develops many surprising points of ignorance about it. For example, questions such as, how much bread ought to be obtained from a pound of flour, do you use spring or winter wheat flour in this region, usually bring to light the fact that women in general are quite ignorant on these two points; yet everyone recognizes that any true estimate of the actual cost of

[1]Lafayette B. Mendel, "Changes in the Food Supply and their Relation to Nutrition," p. 33.

[2]Owen Simmons, "Book of Bread."

bread implies a knowledge of the yield of a pound of flour in bread, and bakers know that, in order to attain desirable results, these two varieties of wheat flour require quite different treatment in the process of bread making.

TYPES OF WHEAT FLOUR

Let us understand then the general differences in these two types of flour in regard to source and properties. (The bread-making processes adapted to the two kinds will be discussed later.) Winter wheat is that type sown in the fall and harvested in the early summer. It is grown usually in the central and eastern parts of the United States where the winters are not severe enough to destroy the crop, while spring wheat is the type grown largely in the northwestern parts of the United States and Canada. In general, the grains differ in appearance: the spring wheat type is harder, yields a flour that has a granular feel, has a larger proportion of gluten, will absorb more water and is known as a "strong, hard wheat flour." In distinction from this, the grains from winter wheat are larger, softer, the flour has a powdery feel, a smaller percentage of gluten and a larger percentage of starch, and is known as a "soft flour."

THE FEEL OF FLOUR

The woman who handles flour readily distinguishes this difference in feel, but she does not learn to interpret this difference in terms of a bread recipe,—that is, she does not understand that the granular one will take up more water, or, to put it another way, that spring wheat flour will require less flour to a given quantity of liquid than a winter wheat flour. She does not understand that the manufacturer's claim that the housekeeper can save flour by using his variety is based upon just this fact of the difference between spring and winter wheat in this power to absorb water. She needs to know the cost per sack of each variety in her market and the yield in bread of each before she can tell which is really the cheaper for her.

THE COLOR OF FLOUR

Perhaps next to feel in the understanding of the home baker comes color in flour. Now that bleaching of flour is forbidden by law, one is more likely to find on the market flour of a creamy color. If it is very white or grayish, it indicates that the flour probably is not new, and that it contains a large proportion of starch. Age has a tendency to lessen the color. Moreover, *new* flour from spring wheat is apt to have more of the creamy color than that made from winter

wheat, because of the larger proportion of gluten in the former, and the larger proportion of starch in the latter. In any case, a dull gray color does not indicate a good flour for bread making. Neither is it true that a deep cream colored flour will not yield an excellent *quality* of bread. The world has been slow to learn that whiteness is not necessarily a mark of excellence in *quality* in bread. Whiteness has sometimes indicated the use of flour bleached either by age or by chemicals.

TERMS USED

It is clear, then, that it is desirable for the woman who bakes to understand the use and meaning of the terms *feel, color, gluten,* and *strength* as applied to flour, and their influence upon the bread making process. She can have first-hand information in regard to gluten and strength by a very simple experiment.

Take a cup of any two flours which are to be compared. Measure the amount of water required to make each of these into a dough of the same consistency. This will give an idea of their power to absorb water. That is one of the differences between a *strong* and a *weak* flour. Let these doughs stand for an hour. Empty each upon a separate square of cheese cloth, place over a colander or strainer, and wash under running water. The starch will go through the cheese cloth and the threads of gluten will remain on the cloth. When the water goes through clear, presumably all the starch has been washed out and the wet gluten is left. Roll the gluten into a ball and then stretch to show difference in elasticity. Weigh to get difference in wet gluten.

While one experiment is not conclusive, yet by these simple tests one may become familiar with the physical properties of flour and learn to understand the terms *color* and *feel* as applied to flour and their probable influence on the bread made from that flour. One will also understand the difference in gluten, whether it is elastic or not, and can judge something of its ability to expand as a framework for the loaf of bread. This difference between a strong and a weak flour is an important one from the economic standpoint. The strong flour absorbs more water and yields a loaf that weighs more. Flours differ considerably in this respect. In the writer's experience, a pound of flour has yielded in bread from 1.25 to 1.65 pounds. Bakers consider that 1⅓ pounds of bread from a pound of flour is a fair average yield.

BREAD AS FOOD

The prime object in bread making is to secure a nutritious, palatable, and attractive form of food. The value of the cereals as food

is well understood. It is known that when properly cooked, the cereals yield a large amount of easily digested food for a comparatively small sum of money. One thinks of cereals, and rightly, as the chief source of starchy food, but the peculiar value of wheat bread lies in the fact that it is one of the cheapest sources of protein. Again this form of protein known as gluten which occurs in wheat flour enhances the value of the flour because the gluten has the property of expanding and serving as a framework for the retention of air or carbon-dioxide. Because this quality is lacking in the protein of corn and oats, neither of these grains is extensively used for bread. The value of a flour, then, for bread depends upon the quantity and quality of its gluten and upon its strength, and this latter quality is usually judged by its capacity to absorb water. Large bakeries conduct experiments constantly to find just the blend of flour that will absorb the greatest amount of water, or, in other words, yield the greatest amount of bread, or take and retain water.

CHEAP FOOD AND DEAR FOOD

It has been understood for a long time that the terms *cheap* and *dear* as applied to foods include not only the amount of money expended but also the quantity of nutritive materials secured for a given sum, or, to put it in another way, the quantity of building material (protein) and energy (calories) that can be secured. The following table shows how favorably bread compares with other food stuffs as regards energy.

AMOUNTS OF COMMON FOODS EQUIVALENT IN ENERGY (1174 CALORIES) TO ONE POUND OF BREAD

Food as purchased	Weight, *grams*	Measure	Cost per 1174 calories	Market price *Mch. 1, 1920*
Bread	453.6	1 lb. loaf	$ .1000	$ .10 lb.
Rolled oats	295.8	3¾ cups	.0670	.1037 lb.
Beans, navy	340.4	1⅔ cups	.0823	.11 lb.
Rice	334.5	1⅔ cups	.1475	.20 lb.
Butter	152.6	7 cu. in.	.2421	.72 lb.
Milk	1696.4	1¾ qts.	.2607	.15 qt.
Potatoes	1755.1	11 large	.2709	.07 lb.
Cheese	267.7	9⅓ oz.	.2832	.48 lb.
Prunes	459.0	1 lb.	.3504	.35 lb.
Beef, round	751.4	1⅔ lbs.	.4971	.30 lb.
Carrots	3354.1	6⅔ lbs.	.6655	.09 lb.
Onions	2672.0	5⅞ lbs.	.7069	.12 lb.
Oranges	3173.0	14 large	.9900	.85 doz.

From this table it appears that even with the present high prices 10 cents' worth of bread yields as much energy (calories) as 24 cents'

worth of butter, 27 cents' of potatoes, 35 cents' of prunes, or 50 cents' of beef. The only foods listed which are less expensive sources of energy are rolled oats and beans, both of which require a considerable expenditure of time and fuel in preparation.

CHEMICAL COMPOSITION

The relation between the chemical composition of spring and winter wheats, as well as wheat, flour, and bread, is shown by the following figures:

	Water	Protein	Fat	Carbohydrates	Ash
[1]Wheat					
Spring varieties	10.4	12.5	2.2	73.	1.9
Winter varieties	10.5	11.8	2.1	73.8	1.8
[2]Flour					
Minnesota Standard Patent	10.54	11.99	1.61	75.36	.5
Bread from Minnesota Standard Patent	34.1	9.	1.30	54.9	.7
[3]Bread—Average of 198 analyses	35.3	9.2	1.3	53.1	1.1

[1]Helen W. Atwater, "Bread and Bread Making," Farmers' Bulletin 389, U. S. Department of Agriculture, p. 16.
[2]Ibid., p. 41. [3]Ibid., p. 38.

Climate, soil, and rainfall influence the composition of both wheat and flour, so the figures showing the chemical compositions vary. One hundred and ninety-eight analyses of bread give a fair average of its chemical composition. For practical purposes one would do well to remember that, chemically speaking, bread is approximately one-third water, one-tenth protein, and one-half starch.

It is evident from the above table that various changes are wrought in converting wheat into flour and flour into bread. These changes are greatest in the conversion of flour into bread. The process of bread making is accomplished by the addition of a liquid—milk, water, or potato water—and yeast to the flour. Usually fat, sugar, and salt are added also. The flour, by the addition of the liquid, is converted into dough. The yeast cells are separated and distributed through the mass of the dough. The yeasts grow and multiply, and in the process of their growth some of the starch of the flour is changed into sugar; carbon-dioxide and alcohol are formed from the sugar. The distribution of this carbon-dioxide through the mass makes it light. Gas cavities are formed throughout the dough in the process of rising, and it is upon the number, size, and distribution of these cavities that the lightness and grain of the bread depends.

When the loaf is baked, the heat of the oven causes the gas to expand, the alcohol to be driven off, the protein to coagulate and set, forming the walls of these cavities and a framework, as it were, for

the loaf. Some of the starch is changed into dextrin. Thus the crust is formed. It is the dextrin which gives the crust its glazed appearance.

As shown by the chemical composition given above, there is a large gain in the proportion of water in the bread, and a small loss in nutritive material due to the conversion of the starch into alcohol and the changes wrought in the protein and fat.

CHARACTERISTICS OF GOOD BREAD

It is perhaps well at this point to give what are regarded as the characteristics of a good loaf of bread. Authorities, as Simmons' Book of Bread, Jago's Technology of Bread Making, and United States Government Reports, agree quite generally in the characteristics of good bread.

1. *Symmetry of Shape.*—The size should be such that the crust will not be baked too hard in order to bake the crumb thoroughly. It is just at this point that the busy housewife often fails. In her desire to get a large quantity of bread ready for the workmen who are with her, she uses the dripping pan, puts into it three loaves so as to gain space in the oven, and does not realize that in order to bake the center loaf the heat must penetrate that mass of moist dough, which is not nearly so good a conductor of heat as the metal of the pan which is on the bottom and sides of the end loaves, so, as a frequent result, the end loaves are scorched before the middle one is baked.

Better results in baking can be obtained by the use of smaller pans which can be moved about, because most ovens have a different temperature in the center than at the edges, and if single pans are used, or, at most, those which hold but two loaves, a more even crust and a better baked crumb can be obtained; and it is to be remembered that the crust is the most easily digested part of the bread, and that underdone, soggy crumb is very indigestible.

2. *Crust.*—As regards the crust, there is considerable difference of opinion concerning the depth of color, some preferring a deep golden brown, others a very light shade, but all like a uniform color over the whole loaf and a certain crisp quality obtained from a slack dough well aerated and quickly baked.

Simmons says:

> "These surface cracks or lines are a sign of quality and are formed usually when the dough is cooling and give the crackling sound regarded as a sign of good bread. A tough, leathery crust may mean an immature dough, that is, dough not sufficiently fermented or a crust rendered thick and hard by a cold oven. A crackly, pliable, thin crust indicates a superior loaf."

3. *Crumb.*—Many qualities are demanded of the crumb of good bread. It must feel and look light, have the gas cavities evenly distri-

buted and of small size, with thin and delicate cell walls. Bakers say that the gas cavities should be oblong in shape rather than round. There must be no heavy streaks at the sides or bottom of the loaf, no marks of bad kneading or chilling. There must be elasticity, so that the part will resume its orginal shape after pressure is removed. The crumb must be tender, neither crumbly nor doughy. As said before, creaminess in color is to be preferred to whiteness, and, above all, good bread should have the flavor of the wheat grain,—should give the characteristic taste of the wheat grain when chewed.

ESSENTIAL FACTORS

Even a superficial study of bread reveals that here, as in most processes and products, there are essential and non-essential ingredients. One finds very general agreement that flour, yeast, and liquid are essential ingredients, while sugar, shortening, and salt, though desirable, cannot be considered as essential to the production of a loaf of bread.

RECIPES

In order to secure the consensus of opinion by those in authority in regard to these ingredients, the amount and proportion of them used in bread, Miss Jensen compiled from standard cook books twelve recipes for the making of bread, and tabulated the amounts of essential and non-essential ingredients which the different authorities asked for. The results are shown in the table on page 12.

DISCUSSION OF TABLE

Evidently most authorities prefer to use three cups of flour to one of liquid; only two suggest a different proportion; water has the preference as the liquid, though five suggest the use of milk; the amount of yeast used varies considerably, from one-eighth to one and one-half cakes per loaf; shortening varies from none to six teaspoonfuls, but five omit it altogether; sugar is omitted by three, while the nine others vary the amount from one-half to three teaspoonfuls. While no recipe omits salt, there is less variation in the amounts used, viz., one-eighth to one teaspoonful.

One should observe not only the actual amounts used, but also the relation these three ingredients, shortening, sugar, and salt, sustain to each other. Three recipes omit shortening and sugar entirely, two recipes call for equal measures of sugar and salt, but there is quite general agreement in the idea that the measure of sugar should exceed that of the salt (in one case six times as much), while in six cases the quantity of the shortening exceeds that of both sugar and salt. After looking at such a table, the question arises, what influence

[1]BREAD RECIPES (ONE LOAF)

References	Flour	Liquid	Yeast	Shortening	Sugar	Salt
	cups	*cups*	*cakes*	*tsp.*	*tsp.*	*tsp.*
Young Housekeeper (Parloa)..	4	1 water	¼	3	1	½
Kitchen Companion (Parloa)..	3+	1 water	⅛	0	¾	¾
Lowney's Cook Book (Howard)	3	1 water	½	3	1½	1
Boston Cooking School (Farmer)	3	1 water	⅛	3	1½	¾
Vegetable Cookery (Rorer)....	...	1 water	¼	0	0	⅛
Practical Cooking and Serving (Hill)	3	1 water	⅛-1½	6	3	½
American School of Home Economics	...	½ milk ½ water	¼-1	3	3½	1
Theory and Practice of Cookery (Williams and Fisher)..	3	½ milk ½ water	½	0	0	½
Mrs. Alice Kirk, of Cleveland..	3	½ milk ½ water	¼	3	¾	½
Home Science Cook Book (Lincoln and Barrows)	3	Milk or ½ milk ½ water	¼-1	0	½	½
The Art of Cookery (Ewing)..	...	½ milk ½ water	1	0	0	½
Selection and Preparation of Food (Bevier and VanMeter)	3	1 water	¼	1	2	1

[1]Catherine Jensen, Master's Thesis 1912, A Critical Study of the Materials and of Some of the Processes Used in Bread Making, p. 20.

have the quantity and quality of yeast, and the proportion of shortening, sugar, and salt on the final product, the loaf of bread. Fortunately, an answer to these questions is found on consulting further the work of these students.

RECIPE USED

[2]The recipe and method of procedure by Miss Williams were as follows:

Salt	1 tsp.	(6 g.)
Sugar	1 tsp.	(5 g.)
Butter	1 tsp.	(5 g.)
Water	1 cup	(260. c.c.)
Compressed yeast	½ cup	(7 g.)
Gold Medal Flour	3.6 cups	(440 g.[3])

[2]Anna W. Williams, Master's Thesis, 1912, "A Study of the Factors of Bread Making with a View to Determination of Standards," p. 3.

[3]There are 453.6 grams in one pound, so this was a little less than one pound.

"The cup of water, having been measured at room temperature, was warmed to 42° C. (107.6° F.); three-fourths of it was added to the butter, salt and sugar, in a mixing bowl, and one-fourth of it was used to soften the yeast. The yeast mixture was added to the liquid in the bowl; then the flour, slightly warmed, was beaten in gradually. The dough was kneaded for 20 minutes, and put to rise at 26° C. (78.8° F.), until doubled in bulk. It was then made into a loaf and again put to rise until doubled in bulk in the pan. In many cases three risings, instead of two, were allowed. The loaf was baked in a gas range for 45 minutes. The oven temperature most used was 180° C. (356° F.) for 10 minutes, 180°-235° C. (356°-455° F.) rising very gradually during 15 minutes, and 218° C. (424.4° F.) for 20 minutes. The size of the pan was 8½x3½x3 inches."

PROCESSES

"This method, termed the short process, required six or seven hours for completion according as to whether two or three rising were allowed. The changes in method which were made in order to produce a long-process bread were as follows: (1) One-fourth of a cake of dry yeast was used, instead of compressed yeast. (2) The ingredients were mixed at night, only 1½ cups of flour being used; this sponge was thoroughly beaten and placed at 21° C. (69.8° F.) to ferment over night. In the morning the remainder of the flour was worked in, and the resulting dough allowed two subsequent risings."

There seems evident gain in reducing the time of the process of bread making. In fact, one great reason for the extensive use of compressed yeast is that its use enables the bread maker to complete the entire process in from five to seven hours. This avoids the difficulty that frequently arises of keeping the sponge warm at night, and since this is sometimes accomplished by the unsanitary method of wrapping the pan containing the bread in a woolen shawl or blanket, soiled by use, it is desirable to find a method involving less risk to the flavor of the bread.

The five or seven-hour process allows the whole work to be accomplished in the daylight, while the housewife is carrying on the day's work and the maintenance of the proper temperature for the bread is a necessary accompaniment of other operations in the kitchen. In the short process, compressed yeast was used because it facilitates measuring the quantity used.

STUDY OF ESSENTIAL INGREDIENTS

YEAST

The usual forms of yeast on the market are compressed and dry yeast. Liquid yeast can be secured at most bake shops, from which some women prefer to secure it as needed, while others prefer to make it in their own homes or to buy in the market one of the two forms to be found there. In any case, all women recognize that the essential part of the product is the yeast plant, which, in the dried cake, may be combined with corn meal as a carrier. (Sometimes the flavor of

the bread is spoiled by the rancidity of the corn meal used.) "Compressed yeast" is a term applied to yeasts grown in a special way, purified by repeated washing, and compressed into cakes by the addition of corn starch or other binding material. It has the advantage of giving a large amount of yeast in a small bulk, but care is needed in keeping it because it deteriorates rapidly on exposure to air or warmth.

Home-made yeasts are essentially mixtures of flour, water, and potatoes, with the dry yeasts found in the market or with other yeast as a "starter." Home-made yeast is sometimes made into cakes as is the dry yeast of the market, but more often it is kept in liquid form or in that of a sponge. Much difficulty has arisen in the use and care of home-made yeasts because of a failure to appreciate the fact that yeasts are plants and therefore require conditions favorable for plant growth. Moreover, careless or uncleanly handling of the yeast in regard to the vessel in which it is kept allows bacteria to mingle with the yeasts. As these multiply, they sometimes give an unpleasant flavor to the bread. The practice of keeping a bit of dough in the flour barrel as a "starter" is not to be commended, and the woman who does not understand "why this yeast that made such good bread a month ago will not work now," will find a probable explanation in the fact that the yeast has taken from the potato water, or the flour and sugar, all the food they contained for the yeast plant and so it has died from starvation, or from the poisonous effects of its own growth. Meantime the bacteria have increased in number and given an acid character to the bread, resulting in the familiar undesirable sour flavor so characteristic of certain home-made breads.

Miss Williams' experiments confirmed previous work done in this laboratory in regard to the deterioration of home-made yeasts and seemed to establish the fact that the way to maintain such yeasts in good condition is to change the medium frequently, that is, make the yeast frequently—in summer as often as twice a week—or at least give the plants new food in the form of sugar or water or both, and keep in a cool place. Even a change of the vessel or addition of water gives air and apparently revives the yeast.

She speaks on the deterioration of yeasts as follows:

[1]"The quantity of bread produced seems to depend to a large extent upon the activity, and consequently upon the age of the yeast cells, those being neither new nor old giving best results.

"For maintenance of a healthy, active growth of yeast, there must be frequent change of the medium of growth; this is probably due to the fact that if allowed to remain unchanged, too great a concentration of by-products is formed.

[1]Miss Williams' Thesis, p. 44.

Simmons[1] says 'Yeast cannot ferment healthily when surrounded by excess of alcohol; to keep in active state yeast must be brewed twice a week; do not use sponge after the fourth or fifth day in any case'; also, 'Yeast in sugar water reaches a stage where it will not continue to act until the water is changed.' Lindet[2] says in substance, the process of refreshing yeasts, as carried on by the baker, by the addition of flour and water to a portion of the dough, is less for the purpose of supplying the yeast new food than for helping it to overcome bacterial or acid fermentation, and for diluting a toxic substance which Hayduck showed was formed at the expense of the proteins of the flour. Many other investigators[3] speak of this toxicity of flours toward yeasts. In addition to this necessity for change because of harmful by-products, there is also a necessity for oxygen, and yeast action is accelerated merely by change from one vessel to another, air being introduced.''

QUANTITY OF YEAST

One objection to the use of liquid yeast is because it is difficult, if not impossible, to determine the quantity available in a given measure, as a cupful. If a pound of compressed yeast is secured, one may establish a very definite relation between the proportion of yeast used by starting with one-half cake per loaf and increasing the amount regularly, say to eight cakes per loaf. Experiments of this kind showed that as the amount of yeast increased, the time of rising decreased,—in this particular instance from one hour and fifty-five minutes for the rising with one cake of yeast, to one hour with five cakes per loaf. The maximum volume was reached in loaves G and H with five and six cakes of yeast, respectively. See Plate II.

Excess of yeast of course increases the cost and does detract from the appearance of both the crumb and the crust, and is, therefore, not to be commended. While excellent results, as regards texture, time, and tenderness, may be attained with as high as two cakes per loaf, it is not an economical procedure, and one-half cake is ample. Moreover, experiments show that if sufficient *time* is allowed, a small quantity of yeast will yield as good results as a much larger quantity.

FLAVOR BY YEAST

Excess of yeast also gives increase of volume and of crumbliness and causes some loss of color in crust. Its influence upon the flavor seems to be an unsettled one, though the common opinion seems to be that an excess of yeast causes a loss of flavor. People frequently speak of the yeasty flavor of bread. In the writer's opinion this flavor is due, in many cases, to the condition of the yeast or the material

[1]Simmons, ''Book of Bread,'' pp. 48, 53, 54.

[2]L. Lindet, ''Role of Yeast in Baking,'' Compt. rend. 150, 802-4.

[3]Baker and Hulton, ''Toxicity of Flours Towards Saccharomyces Cerevisiae,'' and ''Behaviour of Wheaten Flours Towards Baker's and Brewer's Yeasts,'' Journ. Soc. Chem. Ind., vol. 28, p. 778.

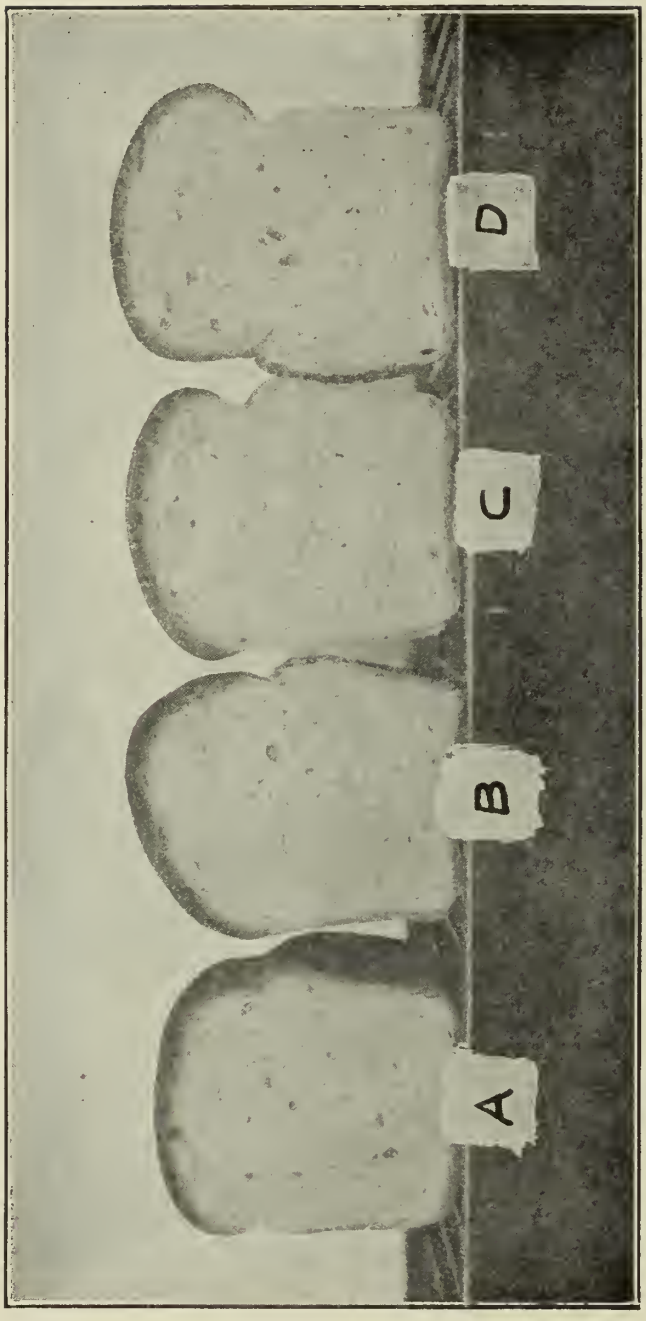

PLATE I. VARYING PROPORTIONS OF YEAST

Loaf	A	B	C	D
Cakes of Yeast	½	1	1½	2

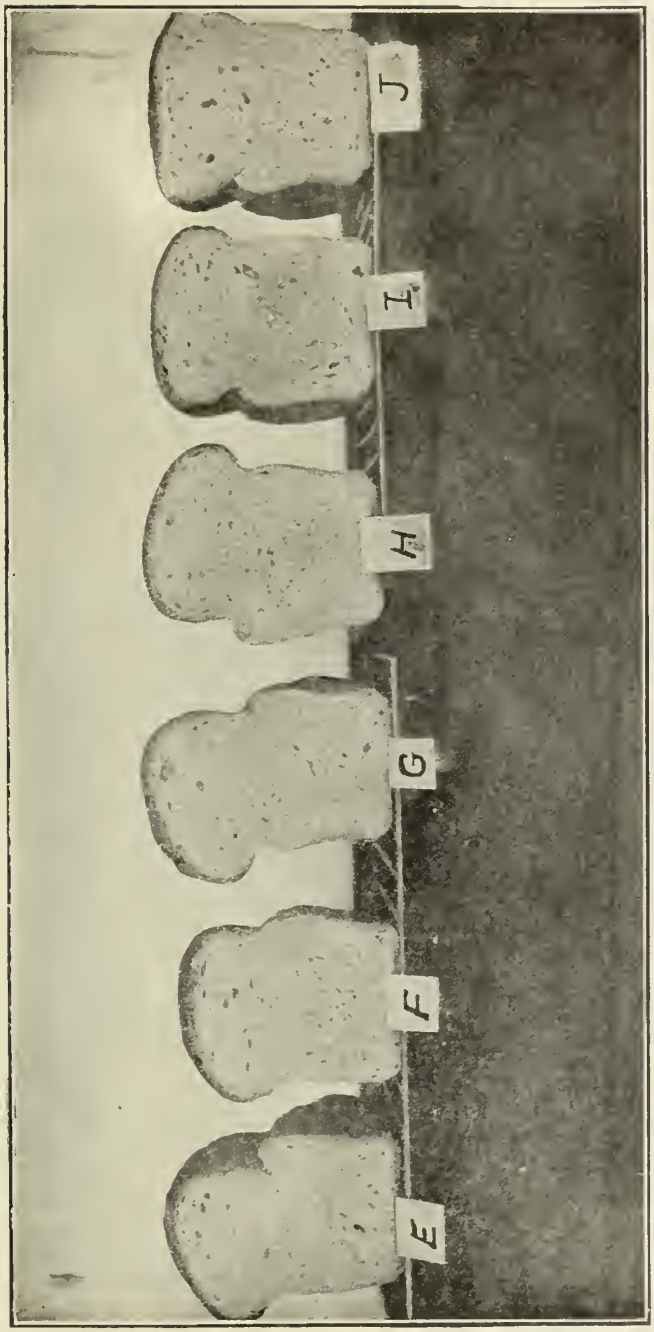

PLATE II. (PLATE I continued)

	E	F	G	H	I	J
Loaf Cakes of Yeast	3	4	5	6	7	8

with which it was combined. Corn meal, for example, will grow rancid and give a bad flavor to a yeast cake. [1]Miss Wardall failed to find that the flavor was influenced by yeast in good condition, while Miss Williams' experiments seemed to show a deterioration of flavor when more than three cakes per loaf were used.

Simmons says:

"Much importance is placed by some people on the kind of yeast used, but on the same principle as the salt and vinegar, the yeast is not added in sufficient quantity to give a direct flavor of its own. In fact, any flavor is chiefly due to the amount of fermentation that the yeast is allowed, by time or heat, to produce. When the system of straight doughs first came into vogue with large quantities of yeast, it was frequently remarked by those who were counselled to use it that such larger quantities of yeast would taste, and it was frequently futile for the author to point out the fallacy of such a statement. The indisputable proof to the contrary, however, is given by the fact that bread is frequently made for special purposes with even five pounds of yeast to the sack, and has no yeasty taste whatever when properly managed, in fact, not merely so much of this so-called yeasty taste as in the case of very much less yeast under other conditions, as, for instance, with a small quantity worked a long time."

LIQUIDS USED

There are two points to be considered regarding the liquid used in bread, viz., the proportion and the kind. It has already been stated that most recipes give one cup of liquid to three of flour as a desirable proportion. In the experiments conducted in this laboratory, a different proportion has been found to be desirable. Of course, exactness is best attained by weight rather than by measure. Persons have been known to differ about one-half cup by measure for the same weight of flour. Four hundred and forty grams—almost one pound or 3.6 cups—of spring wheat flour to one cup of liquid, with short process, in this laboratory has been found to give most satisfactory results as regards shape, size and general characteristics of loaf. A larger proportion of liquid gives a soft dough which on baking is likely to be slightly flat on top, to seem of heavy weight with a tendency to clamminess of crumb and coarseness of texture, while less liquid yields a stiff dough, usually a loaf rounded on top and of finer texture, with a tendency to crack open during baking. The kind of liquid is subject to perennial interest and one often used by food faddists who praise at intervals the merits of buttermilk bread, of sweet milk bread, and of potato water bread. Experiments seem to show that, in so far as flavor is concerned, no liquid is better than water. Milk and potato water both improve the keeping quality, contribute to the tenderness of the crumb, the color of the crust, and the

[1]Ruth Wardall, Master's Thesis, 1907, "The Relation of Yeast to Flavor in Bread," Journal of Home Economics, vol. II, p. 75.

elasticity. Buttermilk has much the same effect as milk and potato water but differs from them in the fact that it often leaves an unpleasant impression after tasting. The extravagant claims as regards the increase in nutritive value by the addition of milk overlook the fact that the proportion of milk used is small and that chemical analysis shows the composition of milk to be 87 percent water. The addition of potato water may introduce an undesirable element if the potatoes are old or not well washed. On the whole, it seems better to add the cooked potato to clean, warm water rather than to water in which old, green, and possibly unclean potatoes have been cooked.

So much for the essential ingredients in the process of bread making. The non-essentials, shortening, sugar, and salt, are next to be considered as to their influence on the product.

STUDY OF NON-ESSENTIAL INGREDIENTS

By reference to the table on page 12 it will be seen that opinions differ widely concerning the use of the non-essentials. Five omit shortening entirely, five advise three teaspoonfuls per loaf, while the remaining two recipes call for one and six teaspoonfuls, respectively. Just the exact role which shortening plays in the process is not known. It is supposed to give tenderness to the crumb and to prevent the drying out of the bread. The use of shortening is not, as is that of the other non-essentials, confined to the interior of the loaf. It is a quite common practice to grease the dough while rising to prevent the formation of a hard crust, while some brsuh lard or butter over the hot loaves when first taken from the oven, to soften the crust. This latter process seems to the writer undesirable because much more of the lard or butter is likely to be added than can be absorbed, leaving the loaves, when cooled, greasy and unattractive. Moreover, this process detracts from the crispness of the crust, which is a very desirable attribute. Fortunately, more data is available concerning the use both of sugar and of salt. It is easy to show that both of these substances have a very material influence upon the flavor. Some people, for instance, like the very sweet taste obtained in the use of much sugar, while others object to it because it conceals the characteristic flavor of the wheat grain. They do not wish their bread, by its flavor, to suggest cake.

USE OF SALT

Again the use of salt to avoid a flat taste is very general. The work done by Miss Jensen on these ingredients seems to indicate that salt, as is to be expected from its antiseptic properties, inhibits the growth

of the yeast and therefore retards fermentation. In these particular experiments, two teaspoonfuls per loaf checked it three and one-half hours, and any larger amount checked it entirely. Moreover, salt affected both the weight and the volume of the loaf, as well as the color of the crust and the tenderness of the crumb. The weight increased with the increase of the amount of salt, while the volume was decreased by the addition of more than one teaspoonful per loaf. The crust lost in color and the crumb in tenderness, flavor, and texture when more than one teaspoonful of salt per loaf was used, though flavor and texture were improved by the use of this amount.

USE OF SUGAR

The results from the use of sugar were quite different. Sugar, of course, serves as a food for the yeast plant and so hastens the fermentation and decreases the total time of bread making. The effect upon the volume of the use of sugar was not so apparent as in the case of the use of salt, but it was quite the reverse, for with sugar, after one teaspoonful, up to four or six, there was a steady gain in volume, while with the salt there was a decrease in volume.

Perhaps the most striking effect was the deepening color of the crust as the amount of sugar was increased. The best results, however, on the loaf as a whole in regard to both flavor and texture, were secured by the use of two teaspoonfuls per loaf. Any excess of sugar beyond this amount seemed to give a certain toughness to both crust and crumb.

SALT AND SUGAR

These data concerning the influence of salt and sugar used separately were obtained that one might be aided to form an intelligent idea about the amount to be used in combination in the making of bread. Miss Jensen conducted experiments to determine the combined effect of varying proportions of sugar and salt as regards (a) the quality of the bread, and (b) the volume of the loaf. Her results are given below.

[1] "Examination of results shows that when the proportion of salt, 1 teaspoonful to the loaf, remained constant as the proportion of sugar added was increased, the total time required for the bread-making process was greatly decreased. This time varied from 7 hours, 30 minutes, in bread which contained no sugar, to 5 hours, 40 minutes, in bread which contained 4 teaspoonfuls of sugar per loaf. Results also show that when the salt factor was increased to 2 teaspoonfuls per loaf, the fermentation was retarded, as was to be expected, moreover, fermentation was not hastened as much by the addition of sugar as it was in the bread containing less salt. The time in these experiments varied from

[1] Miss Jensen's thesis, p. 48.

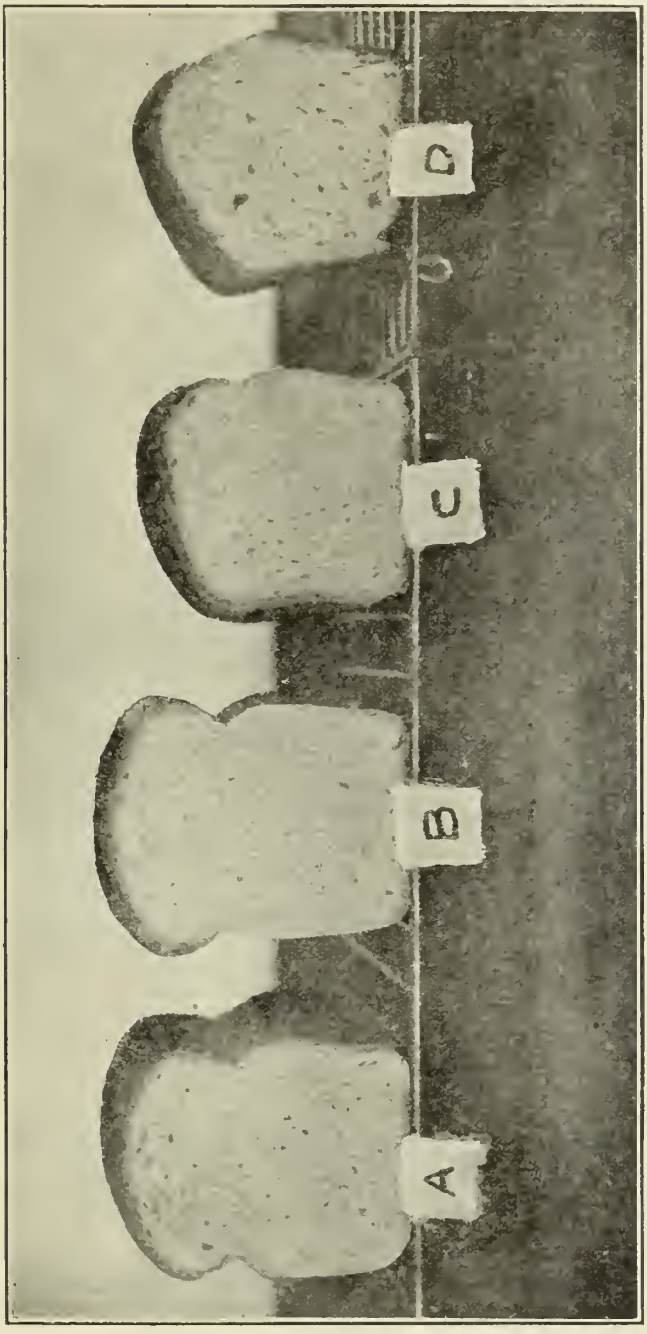

PLATE III. EFFECT OF SALT

Loaf	A	B	C	D
Teaspoonfuls Salt	0	1	2	3

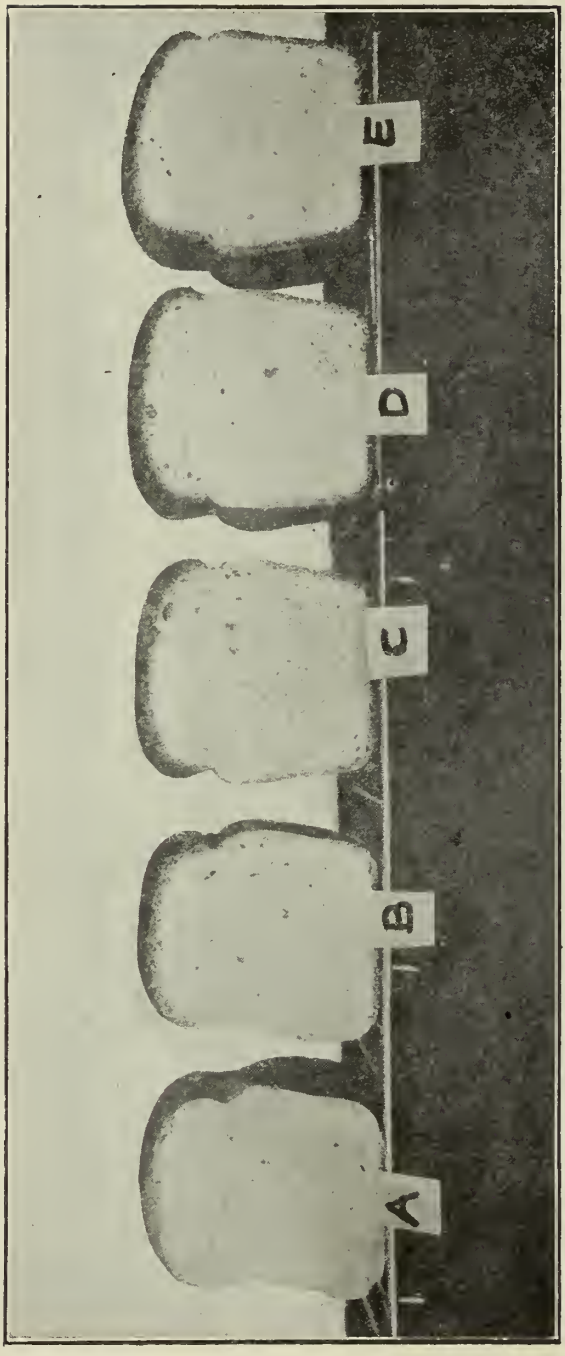

PLATE IV. EFFECT OF SUGAR

Loaf	A	B	C	D	E
Teaspoonfuls Sugar	0	2	4	6	8

9 hours and 45 minutes in bread containing no sugar, to 8 hours and 30 minutes in bread containing 4 teaspoonfuls of sugar per loaf. It should also be noted that breads containing 1 teaspoonful of salt, and 2 and 4 teaspoonfuls of sugar, respectively, per loaf, viz., loaves D and E, required less time for the entire process than any of the other breads, the time required being only about 5¾ hours.

"It is also evident that as the proportion of sugar per loaf was increased, the salt factor remaining constant, there was an increase in the weight of the loaf. The increase in weight was greatest in bread containing 2 teaspoonfuls of sugar per loaf, and in breads containing 4 teaspoonfuls per loaf. These results are analogous with those recorded in Table V., in which the breads containing 2, 4, 6, and 8 teaspoonfuls of sugar per loaf, respectively, showed a proportional increase in weight.

"Salt, up to one teaspoonful per loaf, and sugar up to 4 teaspoonfuls per loaf, increased the volume. It is interesting that the loaf of greatest volume was obtained by the relative proportions of 1½ teaspoonfuls of salt, and 3 teaspoonfuls of sugar per loaf. This bread, however, was not the best in quality.

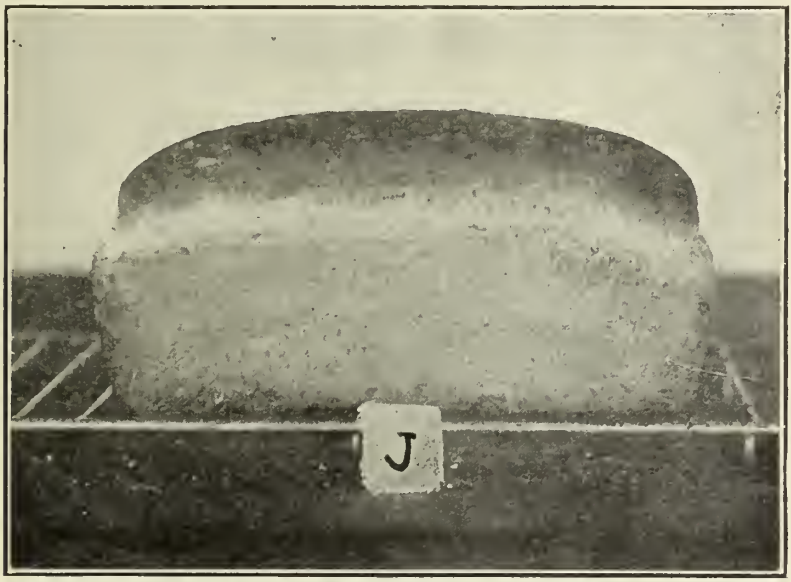

PLATE V. LOAF OF LARGEST VOLUME
Teaspoonfuls Salt 1½
Teaspoonfuls Sugar 3

"When scoring these breads, the majority of judges[1] invariably gave the highest score to breads containing 1 teaspoonful of salt and 2 teaspoonfuls of sugar. These breads were always excellent in shape, with a beautiful golden-brown crust; the crumb was moist yet tender and elastic, the texture fine and even, the flavor sweet and pleasing, and the color of the crumb, a creamy white. Breads containing less than 1 teaspoonful of salt per loaf were scored low, especially in flavor (such breads had flat taste); those containing a greater proportion of salt than 1 teaspoonful per loaf tasted too strongly of salt. Other qualities of these breads were likewise inferior: the shape of such loaves was lopsided, the crust deteriorated in appearance, the crumb tough, coarse in texture and poor in color; breads containing less than 2 teaspoonfuls of sugar per loaf were lacking in flavor, especially when compared with breads containing the

[1]Household Science Faculty, University of Illinois.

PLATE VI. EFFECT OF SALT AND SUGAR

Loaf	B	D	E	F	H	I
Teaspoonfuls Salt	1	1	1	2	2	2
Teaspoonfuls Sugar	0	2	4	0	2	4

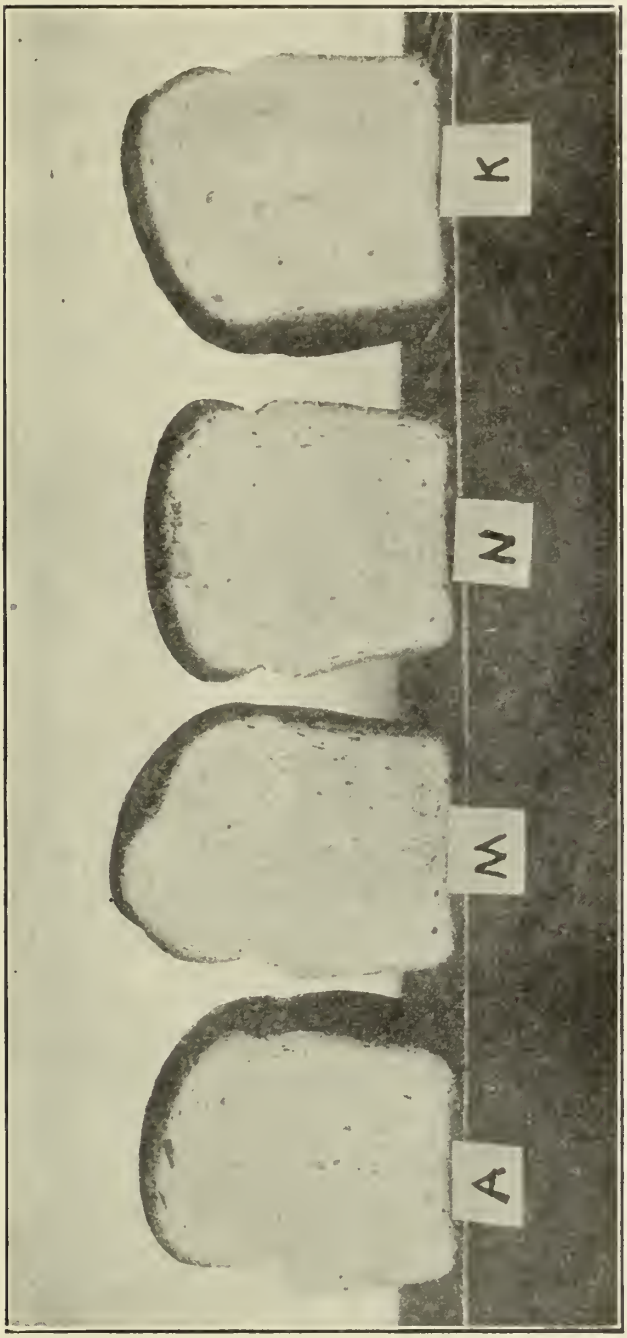

PLATE VII. (Plate VI continued)

	A	M	N	K
Loaf				
Teaspoonfuls Salt	½	2	1	2
Teaspoonfuls Sugar	0	0	2	2

2 teaspoonfuls; more than this amount of sugar per loaf, however, made the bread too sweet.

"From the results of these experiments the proportions, 1 teaspoonful of salt and 2 teaspoonfuls of sugar, per loaf, will henceforth be considered, by the writer, standard amounts. It is interesting to note that not one of the twelve recipes, tabulated on page 12, designate these proportions of salt and sugar. It is of further interest that 1 teaspoonful of salt and 2 teaspoonfuls of sugar, per loaf, were the amounts worked out for the tentative recipe."

BREAD MAKING AND BAKING

Two very important parts of the bread-making process yet remain to be considered after the character and relative proportion of ingredients have been determined. It may as well be understood that bread-making is so complex a process, includes so many factors, that the strictest attention to detail is necessary if one would secure an ideal loaf of bread. The art of making good bread is attained only by those who, consciously or unconsciously, attend to these details. It is just because of the lack of this attention that, to so many housewives, the process of making bread is, as it were, a journey into the great unknown, from which she emerges with a lump of unsavory dough, sour, soggy misshapen, not worthy to be regarded as bread. Under the terms making and baking of breads, many factors could be discussed. A few of the most important ones have been selected.

MAKING

This includes careful selection of materials, correct proportions, cleanliness at every point, suitable utensils, and knowledge of the process of fermentation and of the right way to manipulate the dough. If one understands the processes involved in the fermentation of dough, it may be either checked by cold or hastened by heat, but such changes must be made intelligently.

The temperature best adapted to the growth of the yeast plant is 25°-35° C. (77°-95° F.) Hence the general practice obtains of keeping the bread warm, but "warm" is a very indefinite term. The investment of from one to two dollars in a chemical thermometer would enable the housewife to dispense with this uncertainty of temperature which causes so much havoc in many household operations, including all forms of baking and churning. "The world do move." It may have been all right for our grandmother to have tested the heat of the oven by singeing the hair on the back of her hand, but in a hundred years someone ought to have been shrewd enough to have found a method involving less discomfort to the owner of the hand, as well as a method more easily interpreted by the novice.

METHOD OF PROCEDURE

By reference to the general method of procedure (see page 12) it is observed that both water and flour were warmed and the dough put to rise at a given temperature, viz., 26° C. (79° F.). Later, experiments showed that a variation of temperature between 26° and 35° C. (78.8°-95° F.) did not perceptibly affect the result. Either over-heating or chilling of bread during the last rising seems to result in reducing the volume of the loaf, making the crumb tough and the crust dull.

TIME OF FERMENTATION

This, of course, depends upon the process used in making the bread. Where the whole process of bread-making is completed in five hours, the total time of the rising of both sponge and the dough in the pan is perhaps not over three hours. Where the long process is used, the yeast cake with a little flour started at noon, it may be twenty-four hours before the process is completed. Bakers say the newer the dough, the better the flavor of the bread, while many people feel that a better flavor is secured by a long fermentation. To their minds a certain mellowing and blending of flavors, which they prefer, is attained. It is certain that the two processes produce bread differing considerably in elasticity, grain and texture, and almost always in flavor. The longer fermentation allows time for the development of acid fermentation, and one can detect its presence by odor, if not by taste, in almost all long-process bread. Such bread is usually lighter to handle, more crumbly, and more porous than short-process bread. In this connection the writer recalls the remark of a baker whose shop she was visiting: "Now this bread I lets rise seven hours, but this bread, madam, I makes for the folks who wants all they can get for their money; I gives it to them. I lets this bread rise seventeen hours."

This seventeen-hour loaf was large, coarse-grained, over-light, and sour, to both taste and smell. One would not be understood as conveying the impression that all long-process bread is sour, but rather that there is much greater probability that it will be sour than bread made with short process. In the opinion of the writer, it is more difficult to secure a sweet-flavored bread by the long process than by the short. Moreover, much depends upon the treatment of the dough during the rising process. Some people cut it down occasionally to let out the gas; others knead it two or three times. It seemed pretty well established by these experiments that while two risings did make the bread a little whiter and of finer grain, the third rising did not yield

results that compensated for the extra time and trouble. Miss Williams found that increased time of fermentation, with frequent letting out of gas, gave increasing fineness of texture, mellowness, and pile. When the gas was not let out frequently in long fermentation, silkiness of texture was obtained, but with it a sour flavor, showing that to prevent the sour flavor in the long-process bread, the dough must be frequently kneaded or cut down to allow the gas to escape. She found also that the treatment of the dough in the pan had the most influence on the final product, not only in regard to size and shape, but also in texture and grain.

BULK OF DOUGH

The bulk to which the dough is to be allowed to rise in the pan is an important factor in the results. The general rule that the dough should double in volume seems to yield the best results. Invariably that which rose to three times the bulk gave a coarser texture.

BAKING

The temperature and time, as well as the degree of lightness attained before the baking begins, all influence the general results. Know your oven, is a most important rule for the baker. Good results can be attained even with poor tools if one understands how to manage them, but it seems to the writer a great pity that women are not more insistent upon good tools. No one article, probably, makes for economy and efficiency in the home more than a really good stove with an ample fire box, drafts that regulate the heat, and a thick-walled, well-insulated oven to retain the heat. Much material and energy is worse than wasted by attempting to work with a poor oven.

The novice at bread-making will find it easier to let her bread rise to double its bulk, put it into an oven hot enough to set it at once, and then slowly reduce the temperature and bake her loaf for forty-five minutes or one hour, according to size. Carefully conducted experiments have shown, however, that if one allows the bread to rise to not quite double the bulk, then puts it into an oven at a temperature of 180° C. (356° F.), and allows it to rise for ten minutes as the temperature slowly rises to 220° C. (428° F.), a well-shaped loaf with a good brown crust will be secured. In any case, the temperature of baking must be conditioned on the size and degree of lightness of the dough.

[1]MATERIAL OF BREAD PANS

Two minor points in reference to the baking of bread have been given considerable attention from time to time in the laboratories of this department, viz., (1) the material of the pan used in baking, (2) its size and shape. Miss VanMeter worked with pans of various materials and summarized her results as follows:

"In order to observe the effect upon the bread of the material of the pan used in baking, three experiments were made, using single loaf pans of sheet iron, granite ware and tin. The pans were of practically the same size.

"The temperature used in baking was about 175°-200°C. (347°-392° F.) in each case.

"In every instance the loaves baked in the tin pan had a satisfactory crust, both as to color and to texture.

"The crust of the loaves from the sheet-iron pan showed signs of over-baking. Otherwise the bread was satisfactory.

"Each loaf baked in the granite-ware pan had a hard shiny undercrust which had drawn up from the pan, leaving the bottom of the loaf concave. The texture of the loaf in general was also not so good as in the loaves baked in tin or sheet-iron pans.

"Observations were also made of student work in bread making where tin and sheet-iron pans were used indiscriminately.

"Of twelve loaves made by different individuals and baked in tin pans, eight were first class as to general appearance and crust.

"Of four loaves observed which had been baked in sheet iron pans, none were first class in these respects.

"While these experiments are not conclusive, they do show that tin pans give satisfactory results, while it would appear that if either granite or sheet-iron pans are used, to attain the same results the oven should be at a lower temperature than with tin pans."

UNCOVERED AND COVERED PANS

"Four experiments were made using pans of sheet-iron 9 inches long, 4½ inches wide, and 2¾ inches deep. The covered pan was made by hinging together two pans of the size given.

"Three of the four experiments were made with 'quick process' bread, using compressed yeast (1 cake to 2 loaves). The fourth was 'long process' using yeast foam (½ cake). The flour used throughout was Pillsbury's Best.

"Temperatures used in baking were as follows:

	Experiment I		Experiment II		Experiment III		Experiment IV	
	°C.	°F.	°C.	°F.	°C.	°F.	°C.	°F.
Initial temperature.....	182.22	360	204.44	400	256.65	494	200	392
In 15 minutes	208.88	408	213.3	416	205.55	402	203.3	398
In 35 minutes	200	392	187.75	370	202.2	....	171.1	340
In 40 minutes	.....	....	.....	....	.....	396	.....	....
In 50 minutes	.....	....	188.5	372	.....	....	.....	....

"In so far as these four experiments are concerned, the following facts were observed:

"The flavor, texture, grain, and color of the bread were not affected by the pan used.

[1]Unpublished data.

"In three cases the loaf baked in the uncovered pan was a trifle deeper than that baked in the covered pan.

"In three cases the covered loaf weighed a trifle (a fraction of an ounce) more than the uncovered loaf.

"In three cases the crust upon the covered loaf was not so thick as that upon the uncovered. This was true at the high temperature used in Experiment III.

"In all cases the crust upon the covered loaf was of better appearance and more tender to the knife."

Various people have worked with the size and shape of pans and have come to a unanimous agreement that it is desirable to have the bottom a little narrower than the top. The slanting rather than the straight sides are preferred. The dimensions found most satisfactory in this laboratory are 8½ x3½ x 3 inches.

WINTER WHEAT FLOUR

This discussion has dealt only with spring wheat flour, but in many parts of the country the winter wheat flour is in quite general use. In fact, excellent authorities say that the best bread is obtained by a careful blending of flours from spring and winter wheat. Wiley[1] speaks of a "patent and family flour that will combine the strength and the quality of retaining moisture of spring wheat flour and the sweetness and tenderness of the winter wheat," and, again, "but it cannot be denied that the very best bread in the world is made from the soft winter wheat of France." It is well known that many bakers consider that winter wheat flour makes more tender biscuits and other forms of quick breads.

PROCESS FOR USE OF FLOUR FROM WINTER WHEAT

Miss Jensen worked both with the problem of blending flours and also with developing a satisfactory process for making bread from winter wheat flour. The process used in the experiments with spring wheat flour yielded very unsatisfactory results when tried with winter wheat flour. She summarizes her results as follows:

[2]"It appears that the process of bread making from winter wheat flour differs from that of spring wheat flour in the following particulars:

"(1) Liquid.—For a given weight of flour, winter wheat requires more liquid per loaf than spring wheat flour. A dough from winter wheat flour should be made just stiff enough to hold its shape,—just stiff enough to spring back with the touch of the finger.

"(2) Manipulation.—A winter wheat flour dough requires three risings; it should never get over-light; it should rise to a little less than 1¾ times its original volume in the last rising.

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[1]H. W. Wiley, "Foods and Food Adulterants," Bulletin 13, Division of Chemistry, U. S. Department of Agriculture, part IX, p. 1235.

[2]Miss Jensen's Thesis, p. 67.

"(3) Baking.—Winter wheat flour dough should be baked at 180°-220° C. (356°-428° F.), thus allowing it to finish its proving in the oven. The dough can, with profit, go to the limit of fermentation in the oven.

"(4) Shape of loaf.—The best *shaped* loaf from winter wheat flour is produced by allowing the dough to double its bulk and then baking at 220° C. (428° F.), but such bread is not of good quality.

"(5) Flavor.—Winter wheat bread is more nutty in flavor than that from spring wheat.

"(6) Time.—The total time required to make a loaf of winter wheat bread in these experiments was less than that necessary to make a loaf of bread from spring wheat flour."

SCORE CARDS FOR BREAD

Some twelve years since, the writer was impressed with the fact that in teaching the students how to make bread, one ought to set before them a standard loaf as an ideal to be worked for in the making of bread, and, at the same time, to give some measuring unit by which they might judge their results. She had been impressed by the use of the score card in the judging of butter and decided to develop a similar judging card for bread.

The following tentative card was made and later was introduced into the work of the [1]Farmers' Institute by Mrs. S. Noble King, then President of the Woman's Department of the Farmers' Institute. The maker of the score card expected that radical changes would be made in it very soon after its adoption, for she realized that it had many defects, but, for one reason or another, it has been modified only slightly, either by the Farmers' Institute or by the Department of Household Science, and there seems abundant evidence that it has been useful in calling attention to and improving the quality of the bread in regions where it has been used. Other states have found the method desirable, so that many modifications of this pioneer score card are now to be found .

ORIGINAL SCORE CARD OF MISS BEVIER

Flavor		35
Lightness		15
Grain and Texture		30
Crust	Color, Depth, Texture	5
Crumb	Color, Doughiness	5
Shape and size		5
Moisture		5
Total		100

[1]Year Book of the Illinois Association of Domestic Science, 1904, p. 55.

REVISED BREAD SCORE CARD

DEPARTMENT OF HOUSEHOLD SCIENCE

ILLINOIS FARMERS' INSTITUTE

Flavor		35
Lightness		15
Grain and texture		20
Crust	Color, Depth, Texture	10
Crumb	Color, Moisture	10
Shape and size		10
Total		100

The author of the pioneer score card is glad to publish in this connection those suggested by Miss Jensen and Miss Williams.

SUGGESTED SCORE CARD OF MISS WILLIAMS

"From a study of score cards used in other institutions, and experience in judging the qualities of bread by the one in use in this Department, the following score card is suggested.

Points			
40	Flavor	Odor	20
		Taste	20
30	Crumb	Texture	10
		Moisture	10
		Lightness	5
		Color	5
20	Crust	Color	5
		Depth	5
		Crispness	5
		Texture	5
10	General appearance of loaf	Size	5
		Shape	5

"NOTE.—To be of good texture a loaf must be of fine and regular mesh, and of tender, elastic crumb."

SUGGESTED SCORE CARD OF MISS JENSEN

30	Flavor	Odor	15
		Taste	15
40	Crumb	Texture	8
		Color	8
		Tenderness	8
		Elasticity	8
		Moisture	8
30	General appearance	Crust	10
		Size	10
		Shape	10

"It will be noted that in making her score card the writer has omitted the terms 'lightness' and 'grain'; she considers that texture, meaning the even distribution of air cells in comparison with the solid matter, includes lightness; likewise crumb includes grain. Hence, the terms 'grain' and 'lightness' are dropped. Then again she considers that the texture applies directly to the crumb and so it is placed under that head.

"In addition to the terms applying to the crumb, the writer has added tenderness, elasticity, and moisture; the importance of proper baking is thus emphasized, as these qualities are largely dependent upon the baking.

"General appearance, including crust, size and shape, are given a separate heading and a large score; the writer thinks that by emphasizing especially the size and shape of the loaf, the housewife will solve more quickly the problem of making ideal bread, since the doughiness and sogginess are apt to accompany large, misshapen loaves.

"It is considered that flavor will follow as a sequence of the qualities enumerated in the writer's score card, so it is given a lower score than appears in the Illinois Bread Score card."

[1]Simmons gives the following table:

SIMMONS' SCORE CARD

THE WAY POINTS HAVE USUALLY BEEN ALLOCATED AT EXHIBITIONS

	English, Welsh and Irish		Scotch
	Formerly	*Recently*	
Flavor	20	25	15
Color (2) Of crust	20	..	10
(1) Of crumb	20	25	5
Texture	20	25	10
Volume	20	25	10
Maximum	100	100	50

REVISED SCORE CARD OF MISS BEVIER

The writer of this bulletin offers the following modification of her original score card with the explanation following.

General appearance	20
Size (5)	
Shape (5)	
Crust (10)	
Color	
Character	
Depth	
Flavor	35
Odor	
Taste	
Lightness	15
Crumb	30
Character (20)	
Coarse—fine } Texture	
Tough—tender } Texture	
Moist—dry } Texture	
Elastic or not } Texture	
Color (5)	
Grain—Distribution of gas (5)	
Total	100

EXPLANATION OF REVISED SCORE CARD

General appearance is placed first simply because it comes first in the order of impressions which the loaf makes upon the eye. More-

[1]Book of Bread, p. 81.

over, in judging a loaf one cuts it and thereby may destroy its shape.

Crust.—The color and character of the crust enter into the general appearance and are, therefore, grouped with it. The characteristics of a good crust are given on page 10 and may be summarized as follows: brightness of bloom or color, crisp, crackly, pliable, and smooth, (coarse, grainy crust means bad molding).

Flavor.—In all the early work with bread, it seemed most desirable to emphasize flavor because there was so much bread that looked very well and yet was really sour both in odor and to the taste. Moreover, the author feels that emphasis should be put upon flavor in all foods. The teacher habit acquired through the years of teaching inclines her to indicate at once as "below passing" or unworthy of further consideration, any bread that is conspicuously "off" in flavor. Flavor is made up of the two elements, odor and taste. A well-trained nose will detect in the freshly cut loaf the lack of flavor or the approach to sourness before it can be detected by taste.

The degree of fermentation, the quality and condition of the flour, and the amount and character of the added substances, all modify flavor, but the ideal is the flavor obtained by chewing the wheat grain.

Lightness.—This is a quality best shown in the loaf though made up of many elements. It is often judged by size, by apparent weight, by presence or absence of holes, by crumbliness, and these points do enter into the judging of lightness. Possibly the volume per weight of materials used would be more correct, but it is not easy for the home maker to determine volume.

Crumb.—A very large part of the value of a loaf of bread is determined by the condition of the crumb. The author has given the points in judging the crumb in great detail because in previous work she has found much confusion regarding the term texture. She hopes in this arrangement she has indicated in detail the elements that enter into the formation of texture. The Book of Bread gives the following definition for it: "Texture can be defined as being the disposition or connection of interwoven threads or fibers," and again, "A loaf to be of good texture must not only be of fine and regular mesh but also of soft, pliable and springy crumb, that is, not coarse to look at, nor hard or unyielding to the thumb when pressed, nor yielding too much."

If a thin slice of bread be looked at by placing it between the observer and the light, the mesh and the distribution of the gluten walls can be seen easily.

Grain.—There is very general agreement that by grain is meant the distribution of the gas cavities, also their size and number. This, too, may be seen in the thin slice when examining texture.

Elasticity is perhaps best shown in the half loaf by pressing the cut edges together and seeing if they resume the original position when the pressure is removed.

SUMMARY

Bread making is an important industry for women because seven tenths of the bread used is made at home. In this fact lies the opportunity and responsibility to influence the standard.

Lack of knowledge of difference in bread-making qualities of flour from spring and winter wheat is very prevalent. The flour may be distinguished by color, feel, quality, and quantity of gluten. Chemical composition of wheat, flour, and bread, shows that there is a gain in the proportion of water, and a loss in the proportion of protein and starch in converting wheat into flour and flour into bread.

Characteristics of good bread are symmetry of size and shape, bloom of crust as well as crispness, and a tender, elastic crumb of fine grain.

Recipes differ widely as regards non-essentials, sugar, salt, and shortening, but agree as to the proportion of one cup of liquid to three of flour. Yeast is a plant, and so is subject to laws of plant growth as regards food and moisture. If in good condition, yeast probably does not influence the flavor of bread.

Water is the best liquid as regards flavor. Because of the small proportion used and the fact that almost any form of milk is largely water, little effect is produced by the use of skim milk or buttermilk. Both seem to contribute to tenderness of crumb.

Salt prevents a flat taste, retards fermentation, and, used to excess, causes loss of color in crust and of tenderness in crumb.

Sugar darkens the color of the crust. Within limits, it increases the volume of the loaf.

Salt and sugar combined in proportion of one to two respectively improve the flavor and the volume.

Bread making is an art that demands careful attention to certain essential details such as the character, temperature, and amount of the yeast, condition and amount of the flour, time and temperature of fermentation and baking.

Material of pans is a question of choice. Tin seems to yield best results in common practice. Covered and uncovered pans have not been tried enough for definite conclusions.

The process for winter wheat flour differs from the process for spring wheat flour in that winter wheat requires more liquid, a slacker dough, is much better with three risings instead of two, and should be allowed to finish proving in the oven.